



BAY AREA
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AGENDA: 3A

Update on the Status of the Assembly Bill (AB) 617 Expedited Best Available Retrofit Control Technology (BARCT) Schedule

**Stationary Source Committee Meeting
December 17, 2020**

**Victor Douglas
Manager
Rule Development**

Overview



- AB 617 Expedited BARCT Implementation Schedule Review
- Regulation 8, Rule 5 (Rule 8-5): Organic Liquids Storage Tanks
- Regulation 8, Rule 8 (Rule 8-8): Petroleum Wastewater Treating
- Regulation 8, Rule 18 (Rule 8-18): Refinery Heavy Liquids Leaks

Overview Cont'd



- Regulation 9, Rule 13 (Rule 9-13): Portland Cement Manufacturing
- Regulation 9, Rule 14 (Rule 9-14): Petroleum Coke Calcining Operations
- Regulation 6, Rule 5 (Rule 6-5): Refinery Fluidized Catalytic Cracking Units (FCCUs)
- Conclusions

AB 617 Expedited BARCT Review



- AB 617 signed into law in July 2017
- Requires air districts to develop and adopt an expedited schedule for implementation of BARCT at industrial Cap-and-Trade facilities
- Schedule was adopted on December 19, 2018
- Schedule contained six rule development efforts
- Must be implemented by earliest date, but no later than December 31, 2023

AB 617 Expedited BARCT Review

Cont'd



- “Best Available Retrofit Control Technology” is...
 - An emission limitation that is based on the maximum degree of reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of source.
- Does not apply to sources that have implemented BARCT since 2007
- Priority for sources that have not modified emissions limits for longest period of time

AB 617 Expedited BARCT Review Cont'd



Prioritization of Projects

- Local clean air and public health benefits, including toxic emissions reduction co-benefits
- Substantial emission reductions—particulate matter (PM) emissions
- Focused on sources where BARCT controls had not been recently updated
- Cost effectiveness of potential control options

AB 617 Expedited BARCT Schedule



Rule Development Projects

- Rule 8-5: Organic Liquids Storage Tanks
- Rule 8-8: Petroleum Wastewater Treating
- Rule 8-18: Refinery Heavy Liquids Leaks
- Rule 9-13: Portland Cement Manufacturing
- Rule 9-14: Petroleum Coke Calcining Operations
- Rule 6-5: Refinery Fluidized Catalytic Cracking Units

Rule 8-5: Organic Liquids Storage Tanks



Regulatory History

- Adopted in 1978 and last amended in 2006
 - Reduce Volatile Organic Compound (VOC) emissions from storage of organic liquids, like gasoline
 - Standards for floating roof rim seals, pressure vacuum valve setpoint, closure for tank roof fittings, and tank degassing
- 2017 Clean Air Plan Control Measure SS13
- BARCT Schedule Control Options
 - Domes
 - Fixed roof tanks with vapor recovery units
 - Fixed with vapor recovery units and incineration

Rule 8-5: Organic Liquids Storage Tanks Cont'd



Rule Development Process

- Technical research, site visits, Refinery Rules Technical Working Group in 2019
- Draft amendments: Q1 2021
 - 95% control requirement
 - Affects 30 tanks District-wide
 - Estimated total VOC reductions of 100 tons per year
- Board Hearing: Q2 2021
 - Package released: Q1 2021

Rule 8-8: Petroleum Wastewater Treating



Regulatory History

- Originally adopted in 1979 / Last Amended 2004

Rule Development Process

- Staff technical research, site visits, Refinery Rules Technical Working Group in 2019
- Further Emissions Inventory Verification: 2021
 - Emissions estimates vary
 - Secondary treatment systems (“back end”)
 - Do actual emissions warrant rule amendments?
- AB 617 BARCT Schedule Deadline: December 31, 2023

Rule 8-18: Refinery Heavy Liquids Leaks



Regulatory History

- Originally adopted in 1980
 - Reduces fugitive emissions of organic gases
 - Valves, connectors, pumps, compressors
 - Leak Detection and Repair (“LDAR”) programs
 - Refineries, chemical plants, bulk plants and bulk terminals
- Amended in 2015 to included equipment in heavy liquid service
- Heavy Liquids Study at all five refineries
 - Final Results: Q1 2021

Rule 8-18: Refinery Heavy Liquids Leaks

Cont'd



Rule Development Process

- Complete Heavy Liquids Study
 - Emission factors and inventory development
 - Final results: Q1 2021
- Draft amendments: Q4 2021
 - LDAR Program for affected equipment in heavy liquid service
 - Preliminary cost estimates
 - Capital Cost: \$250,000
 - Annual Cost: \$6.8 million
 - Emission reductions: Uncertain

Rule 9-13: Portland Cement Manufacturing



Regulatory History

- Originally adopted in 2012
 - Dust Control Measures
 - Emission limits for Cement Kiln—Oxides of Nitrogen (NO_x), PM, Ammonia, Dioxins & Furans, Mercury, Organic Toxic Air Contaminants (TACs), and Hydrochloric Acid
- 2017 Clean Air Plan—Control Measure SS19
 - Limit Sulfur Dioxide (SO₂) emissions (PM precursor)
 - Address potential for detached plumes
 - Revise ammonia standard
 - Consider Greenhouse Gas (GHG) emissions

Rule 9-13: Portland Cement Manufacturing Cont'd



Consent Decree—Lehigh, US EPA, Air District et al.: Nov 18, 2020

- Penalties: \$1.3 million / \$119,000 to Air District
- Effective November 18, 2021
 - Continuous operation of selective non-catalytic reduction
 - Install NOx continuous monitor on stack
 - 30-day average NOx emission limit: 2.0 pounds per ton of clinker

Rule 9-13: Portland Cement Manufacturing Cont'd



Consent Decree—Lehigh, US EPA, Air District et al.: Nov 18, 2020

- “Test and Set” Protocol for SO₂ emissions from Kiln
 - Protocol Due: January 18, 2021
 - Demonstration & EPA Approval
 - SO₂ limit not to exceed 2.1 pounds per ton of clinker
- Timeline for Consent Decree implementation: Up to 2½ years for final SO₂ limit

Rule 9-13: Portland Cement Manufacturing

Cont'd



Consent Decree Benefits and Impacts Analysis

NOx	Emission Limits (lbs/ton clinker)	Actual Emissions (tons/year)	Allowable Emissions Based on Limit (tons/year)
Current	2.3	1,010	1,265
Consent Decree	2.0	n/a	1,100

Current NOx limits reflect BARCT and no additional rule making for **NOx** emissions is anticipated.

SO₂	Emission Limits (lbs/ton clinker)	Emissions (tons/year)	Emission Reductions (tons/year)	Costs (\$/year)	Cost Effectiveness (\$/ton reduced)
Current	2.4-3.4	1,300-1,850	n/a	n/a	n/a
Consent Decree	0.8-2.1	440-1,150	160-1,415	\$1.5 million	\$1,000 to 9,000

Rule 9-14: Coke Calcining Operations



Regulatory History / Rule Development

- Originally Adopted in 2016
 - Limits SO₂ emissions from coke calcining kilns
 - Phillips 66 operates only facility in Air District
- BARCT Schedule Control Options
 - Limit NOx emissions
 - Selective Catalytic Reduction using ammonia
 - LoTOx using ozone
- Fate of Coke Calcining Kiln
 - Phillips 66 refinery conversion to renewable fuels production
 - Impact on Coke Plant operation is unknown

Rule 6-5: Refinery Fluidized Catalytic Cracking Units



Regulatory History

- Originally adopted in 2015
 - First step to address FCCU condensable PM
 - Requirements to reduce ammonia (a PM precursor)
- 2017 Clean Air Plan
 - Included Control Measure SS1 to further evaluate and address FCCU condensable PM emissions
- Achieve public health benefits and continue progress towards attainment of ambient air quality standards

Rule 6-5: Refinery Fluidized Catalytic Cracking Units Cont'd



Rule Development Process

- Staff technical research, site visits, Refinery Rules Technical Working Group in 2019
- Draft amendments released in May 2020:
 - Modified requirements for ammonia limit of 10 ppm
 - New limits on sulfur dioxide:
 - 25 ppm on a 365-day rolling average basis
 - 50 ppm on a 7-day rolling average basis
 - New limit on total PM₁₀ of 0.020 gr/dscf (filterable and condensable PM)
 - Estimated total PM10 reductions of 250 tons per year

Rule 6-5: Refinery Fluidized Catalytic Cracking Units Cont'd



Rule Development Process (continued)

- Efforts since May 2020 draft release:
 - Evaluation of more stringent control options—Wet Gas Scrubber
 - Presentations to Stationary Source Committee: June, July, and October
 - Additional refinery visits and consultations
 - Further emissions characterization, including additional source testing
- Board Hearing: Spring 2021
 - Dual Proposals for total PM:
 - 0.01 gr/dscf based on installation of wet gas scrubber
 - 0.02 gr/dscf based on installation of electrostatic precipitator
 - Package release: Q1 2021

Rule 6-5: Refinery Fluidized Catalytic Cracking Units Cont'd



Estimated Emissions Reductions and Costs Analyses (0.020 gr/dscf)

Facility	PM ₁₀ Emissions (tpy)	PM ₁₀ Reductions (tpy)	Capital Costs (\$MM)	Total Annualized Costs (\$MM)	Cost Effectiveness (\$/ton)
Chevron Richmond	245	80	\$30	\$4.5	\$56K/ton
<i>Marathon Martinez*</i>	190	0	–	–	–
PBF Martinez	309	170	\$80	\$14.5	\$85K/ton
Valero Benicia	83	0	–	–	–
TOTALS	827	250	\$110	\$19.0	\$75K/ton

* Facility has been indefinitely idled

Rule 6-5: Refinery Fluidized Catalytic Cracking Units Cont'd



Estimated Emissions Reductions and Costs Analyses (0.010 gr/dscf)

Facility	PM ₁₀ Emissions (tpy)	PM ₁₀ Reductions (tpy)	Capital Costs (\$MM)	Total Annualized Costs (\$MM)	Cost Effectiveness (\$/ton)	Incremental Cost Effectiveness (\$/ton)
Chevron Richmond	245	160	\$182	\$31	\$194K/ton	\$331K/ton
<i>Marathon Martinez*</i>	190	93	\$179	\$31	\$330K/ton	–
PBF Martinez	309	240	\$218	\$35	\$145K/ton	\$293K/ton
Valero Benicia	83	0	–	–	–	–
TOTALS*	827	400	\$400	\$66	\$165/ton	\$300K/ton

* *Marathon Martinez has been indefinitely idled; emissions, reductions, and costs are not included in the final totals.*

Conclusions



- Rule 8-5: Organic Liquids Storage Tanks
 - Draft rule language: Q1 2021
 - Board Hearing: Q2 2021
- Rule 8-8: Petroleum Wastewater Treating
 - Pending emissions review
- Rule 8-18: Refinery Heavy Liquids Leaks
 - Finalizing heavy liquid study
 - Rule amendments to follow

Conclusions Cont'd



- Rule 9-13: Portland Cement Manufacturing
 - Implementation of Consent Decree provisions
 - Incremental Analysis to determine need for further regulation
 - Additional source testing
 - Research other cement kilns
- Rule 9-14: Petroleum Coke Calcining Operations
 - Pending Phillips 66 conversion to renewable fuels production
- Rule 6-5: Refinery Fluidized Catalytic Cracking Units
 - Board Hearing: Spring 2021



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AGENDA: 3B

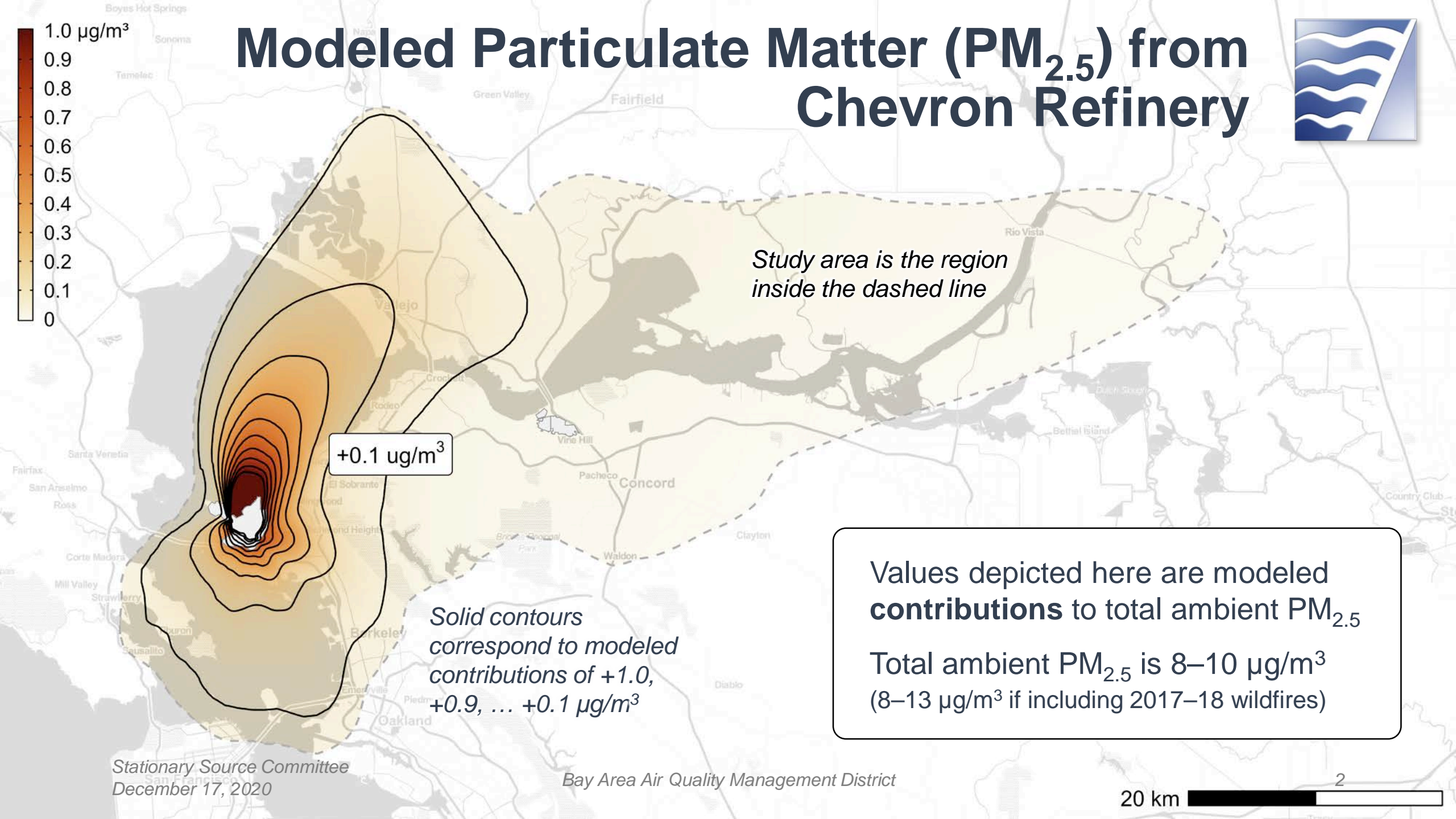
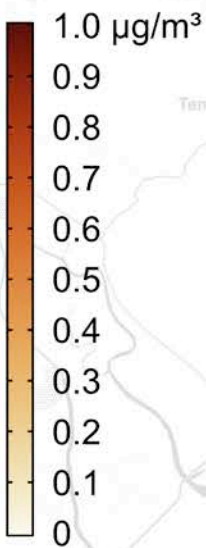
Update on the Status of the Assembly Bill (AB) 617 Expedited Best Available Retrofit Control Technology (BARCT) Schedule - Equity and Health Benefits Assessment for Rule 6-5

**Stationary Source Committee Meeting
December 17, 2020**

**Phil Martien, PhD
Director**

Assessment, Inventory, & Modeling Division

Modeled Particulate Matter (PM_{2.5}) from Chevron Refinery



Study area is the region inside the dashed line

+0.1 µg/m³

Solid contours correspond to modeled contributions of +1.0, +0.9, ... +0.1 µg/m³

Values depicted here are modeled **contributions** to total ambient PM_{2.5}
Total ambient PM_{2.5} is 8–10 µg/m³
(8–13 µg/m³ if including 2017–18 wildfires)

- White
- Hispanic / Latino
- Asian / Pacific Isl.
- Afr. Amer. / Black
- Other

Study Population



Study area is the region inside the dashed line

+0.1 ug/m³

Each dot corresponds to 1 resident
Modeled 2020 population within the study area is **1 million residents**

Population Exposure

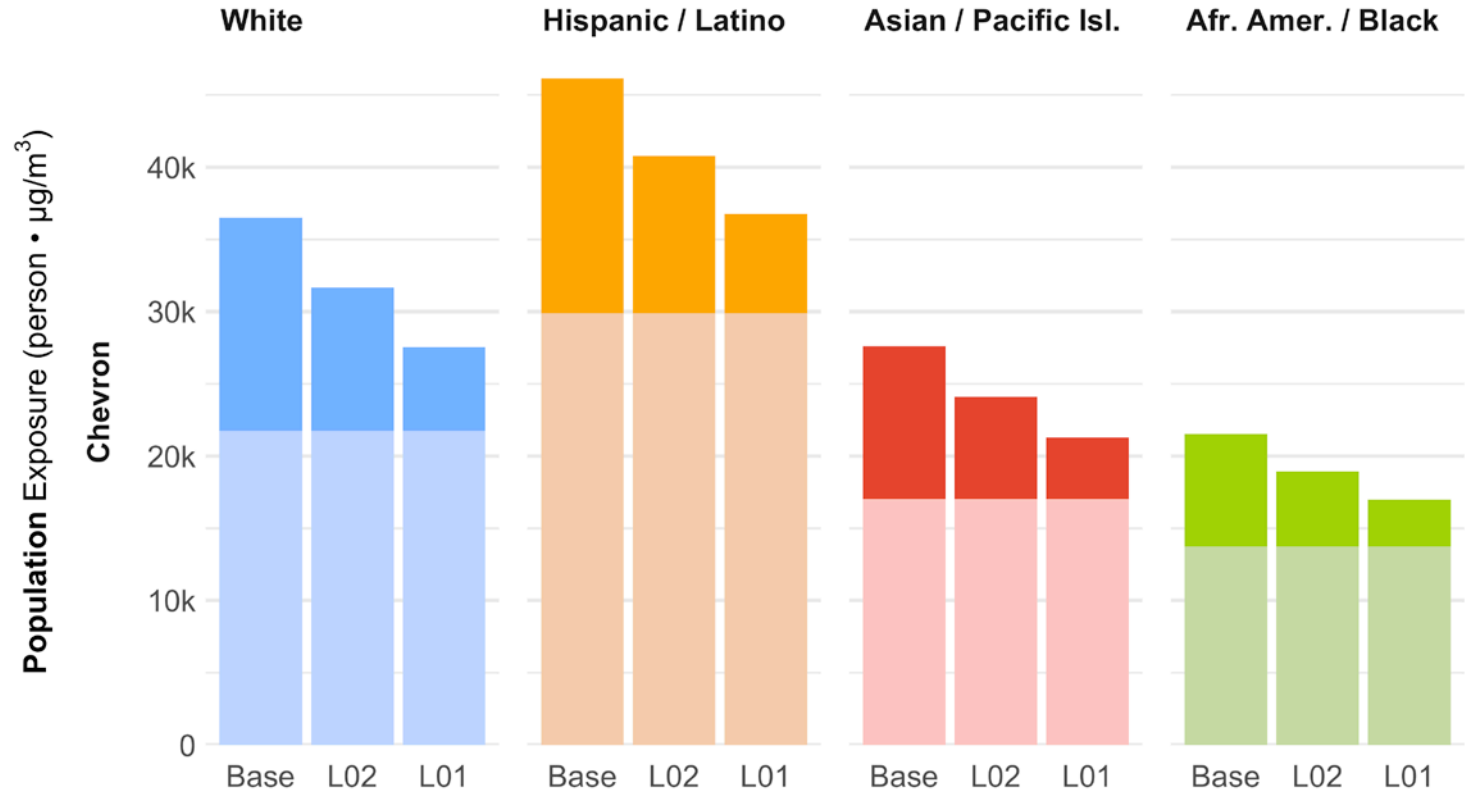


At baseline:

- Hispanic / Latino residents comprise 28% of the population in the study area and 35% of the modeled exposure burden
- Afr-Amer/Black: 12% vs 16%
- White: 37% vs 28%
- Asian/Pac. Isl.: 22% vs 21%

Exposure reductions:

- Limit 0.02 gr/dscf (L02): -12%
- Limit 0.01 gr/dscf (L01): -22%



*Fluidized Catalytic Cracking Unit (FCCU) impacts shown in darker colors
Bar heights = total impacts (FCCU + Non-FCCU)*

Exposure Per Capita

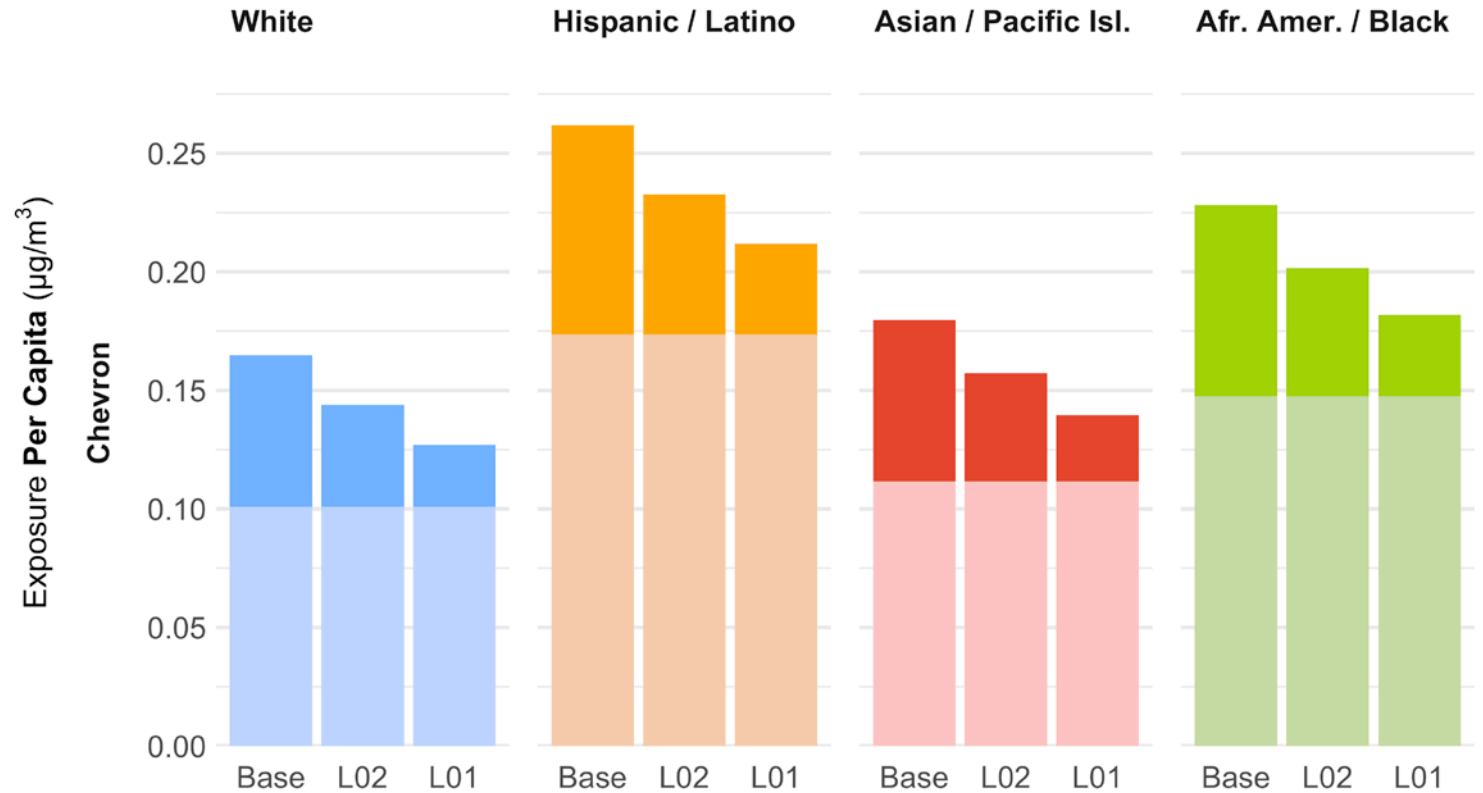


Disparities in Exposure

- On average, Hispanic/Latino and African American/Black residents are exposed to more PM_{2.5} from Chevron in all modeled scenarios

Sources other than the Fluidized Catalytic Cracking Unit (FCCU)

- Drive these disparities
- Remain significant across all modeled scenarios



*FCCU impacts shown in darker colors
Bar heights = total impacts (FCCU + Non-FCCU)*

Health Impacts and Valuations



Estimated Baseline Health Impact from Modeled Sources (Annual)		Valuation ¹ (Annual)	0.020 gr/dscf	0.010 gr/dscf
Cardiovascular	0.5–4.3 heart attacks	\$63k–600k	-13%	-22%
	1.0 hospital admissions	\$47k	-13%	-22%
Restricted Activity	4,800 days	\$360k	-12%	-21%
Lost Work	820 days	\$190k	-12%	-21%
Asthma	200 exacerbations ³	\$12k	-12%	-21%
	4 emergency room visits	\$2k	-12%	-21%
	0.1 hospital admissions	\$1k	-12%	-20%
Respiratory Illness²	140 upper tract ³	\$5k	-12%	-20%
	100 lower tract ³	\$2k	-12%	-20%
	8 bronchitis ³	\$4k	-12%	-20%
	0.2 chronic lung disease	\$5k	-12%	-21%
Mortality	5.1–11.6 deaths ⁴	\$52.5M–118M	-13%	-23%
			\$6.8M to \$15.2M/yr	\$12.2M to \$27.4M/yr



¹ Conventional EPA valuations, in 2015 US dollars
² Other than asthma
³ Subset of pediatric (≤18 years)
⁴ Including infant mortality

Cost-Benefit Comparisons



Estimated Costs and Benefits from Application of Proposed Limits to Chevron

Baseline Emissions ¹	Proposed Limit	Emission Reduction	Annualized Cost	Cost Effectiveness ¹	Annual Benefit ^{2,3}
245 ton/yr	0.020 gr/dscf	80 ton/yr	\$4.5M/yr	\$56k/ton	\$6.8M to \$15M/yr
	0.010 gr/dscf	160 ton/yr	\$31M/yr	\$194k/ton	\$12M to \$27M/yr

¹ PM_{10} from FCCU. Modeled $PM_{2.5} / PM_{10}$ ratio for the Chevron FCCU is approximately 95%.

² Based on conventional valuations of health impacts for which valuations are available.

³ Valuations are in 2015 USD, calculated using the US EPA BenMAP system.